

## A Mosquito Taxonomic Glossary

## IV. Adult Thoracic Appendages\*

Kenneth L. Knight  
Department of Entomology  
North Carolina State University  
Raleigh, North Carolina 27607

Jean L. Laffoon  
Department of Zoology and Entomology  
Iowa State University  
Ames, Iowa 50010\*\*

For a full explanation of this project see Part I (Knight 1970). As before, terms recommended for standardized use are given fully capitalized. Synonyms or terms used in error are in lower case and underlined. Standardized abbreviations are also suggested. Included in this section is an appendix presenting reasons for the recommendation of terms not presently in common use.

As before we wish to acknowledge the provision by Dr. H. C. Chapman of the adult mosquito specimens used for the drawings. The drawings were prepared by Mrs. Yvonne Lee.

Readers are reminded that this is a preliminary presentation and that, when all of the parts are completed, they will be combined, thoroughly revised, and issued under a single cover. Because of this, all individuals interested in mosquito systematics are urged to comment fully on any portion of the included text when they feel this to be necessary.

Part II of this series dealt with terms for those internal head structures that withstand treatment with potassium hydroxide (Knight and Laffoon 1970a). Part III treated the adult thoracic capsule (Knight and Laffoon 1970b).

ALULA(Al). - In many Diptera, a lobe of the posterior margin of the wing bounded proximally by the upper calypter, distally by the axillary incision, and anteriorly by the base of the anal vein. Weakly differentiated in mosquitoes. The term has also been applied to the upper and lower calypteres collectively.

anal cell. - See CELL.

ANAL VEIN(A). - Any principal longitudinal wing vein between the cubitus and the jugum; in mosquitoes, only one anal vein is well developed. (Syn.: vein 6, sixth longitudinal vein.) For alternate terminologies see Table 1.

---

\*Supported in part by the Southeast Asia Mosquito Project (SEAMP) through Research Contract No. DA-49-193-MD-2672 from the U. S. Army Medical Research and Development Command, Office of the Surgeon General, Washington, D. C.

\*\*Journal Paper No. J-6759 of the Iowa Agriculture and Home Economics Experiment Station.

ARCULUS (Ar). - A crossvein between the radius and the cubitus near the wing base in certain insects, including Diptera.

auxiliary vein. - See SUBCOSTA.

axillary cell. - See CELL.

AXILLARY INCISION (AI). - In Diptera, an incision on the inner margin of the wing, near the base, which separates the alula from the main part.

basicosta. - See HUMERAL PLATE.

CALYPTER. - In most winged Diptera either of two posterior lobes of the posterior margin of the forewing between the extreme posterior wing base and the alula. (Syn.: squama [of some authors].) The LOWER CALYPTER (LC) is the proximal calypter (Syn.: squama [of some authors], tegula ) and the UPPER CALYPTER (UC) is the distal calypter (Syn.: squamula).

CAPITELLUM (Ca). - See HALTER.

CELL. - An area of wing membrane delimited by the surrounding veins or by veins and the wing margin. A cell is named after the vein immediately anterior to it or after the posterior element if the vein is formed by the "fusion" of two vein branches. In mosquitoes, specific cells present are: CELL C (Syn.: costal cell) (subdivided by h into 1st cell C and 2nd cell C); CELL Sc; CELL Sc<sub>1</sub>; CELL R; CELL R<sub>1</sub> (Syn.: first marginal cell); CELL R<sub>2</sub> (Syn.: second marginal cell); CELL R<sub>3</sub> (Syn.: submarginal cell); CELL R<sub>5</sub> (Syn.: first posterior cell); CELL M; CELL M<sub>1</sub> (Syn.: second posterior cell); CELL M<sub>2</sub> (Syn.: third posterior cell); CELL M<sub>4</sub> (Syn.: fourth posterior cell); CELL CuA; CELL CuP (Cell CuA and CuP indistinctly separated by the weak and often incomplete vein CuP, together often called "anal cell"); and CELL 1A (Syn.: axillary cell, anal cell of some authors). Some authors call cells M<sub>1</sub>, M<sub>2</sub> and CuA and CuP (collectively), respectively, cells M<sub>2</sub>, M<sub>4</sub>, Cu<sub>1</sub>, Cu<sub>2</sub>, as a result of interpreting the veins differently.

CELLS C, Sc, Sc<sub>1</sub>, R, R<sub>1</sub>, R<sub>2</sub>, R<sub>3</sub>, R<sub>5</sub>, M, M<sub>1</sub>, M<sub>2</sub>, M<sub>4</sub>, CuA, CuP, 1A. - See CELL.

claw. - See UNGUIS.

COSTA (C). - The usual first principal longitudinal vein of the wing, typically expanding completely around the wing margin from its articulation with the humeral plate to the posterior end of the wing base, sometimes absent posteriorly and apically, sometimes somewhat removed from margin.

costal cell. - See CELL.

COXA (C-I, C-II, C-III). - The basal segment of the leg. In some insects, including mosquitoes, one part of the mid- and hindcoxa, the meron (q.v.), is functionally associated with the pleuron. (See LEG)

CROSSVEIN. - A short, usually transverse, vein between two longitudinal veins. In mosquitoes, the usual crossveins are the HUMERAL (h) between C and Sc, the RADIOMEDIAL (r-m) between R and M, and the MEDIOCUBITAL (m-cu) between M and Cu. In many Diptera, Sc<sub>2</sub> has sometimes been called the subcostal crossvein and the mediocubital has usually been misidentified. See table 1 for alternate terminologies.

cross veins 3-4, 4-5. - See RADIOMEDIAL CROSSVEIN AND MEDIOCUBITAL CROSSVEIN.

CUBITUS (Cu). - The usual fifth principal longitudinal vein of the wing, usually with two main branches, CUBITUS ANTERIOR (CuA) and CUBITUS POSTERIOR (CuP) (Syn.: plical vein). In mosquitoes, CuP is faint and closely parallels CuA; both CuA and CuP are unbranched. For alternate terminologies, see table 1.

CUBITUS ANTERIOR (CuA). - See CUBITUS.

CUBITUS POSTERIOR (CuP). - See CUBITUS.

EMPODIUM (Em). - A distal median free prolongation of the unquitractor; sometimes padlike, sometimes spinose.

FEMUR (Fe-I, Fe-II, Fe-III). - In arthropods, the usual third segment (fourth if two trochanters are present) of the leg; generally the largest leg segment; distad to the trochanter. (See LEG).

fifth longitudinal vein. - See CUBITUS.

first longitudinal vein. - See RADIUS.

first marginal cell. - See CELL.

first posterior cell. - See CELL.

fourth longitudinal vein. - See MEDIA.

fourth posterior cell. - See CELL.

FRINGE SCALE (FS). - In many winged insects, any scale in the fringe of the wing. In mosquitoes, one of the single row of long fusiform erect scales set along the dorsal surface of the wing edge.

HALTER (H1). - A modified, reduced, drumstick-shaped hindwing (in most Diptera) or forewing (in male stylopoid Coleoptera) (Syn.: haltere); in Diptera consisting of a thick base, the SCABELLUM (Sl) a slender stemlike part, the PEDICEL (Pc) (Syn.: midhalter, stalk, petiole); and a thick distal part, the CAPITELLUM (Ca) (Knob).

haltere. - See HALTER.

HUMERAL CROSSVEIN (h). - See CROSSVEIN.

HUMERAL PLATE (HP). - The anterior preaxillary sclerite of the wing base supporting the costal vein. (Syn.: basicosta.)

JUGUM. - A posterior basal lobe or area of the wing set off from the anal area by the axillary incision. In Diptera, probably represented by the alula and the upper calypter.

knob. - See HALTER.

LEG. - In animals, one of the paired appendages ordinarily used in locomotion and support; in insects applied only to the three pairs of thoracic legs. Composed in most insects of the coxa, trochanter, femur, tibia, tarsus, and pretarsus. In Diptera, the coxal surfaces are described as though the coxa was in the normal resting position, the surfaces being the outer, inner, anterior, and posterior; the surfaces of the other leg segments are described as though the leg were extended horizontally perpendicular to the insect's longitudinal axis, the surfaces being the dorsal, ventral, anterior and posterior. Individual legs and leg segments are denoted by prefixing fore-, mid- or hind as appropriate, thus foreleg, midfemur, hindtrochanter, etc.

LOWER CALYPTER (LC). - See CALYPTER.

MEDIA (M). - The usual fourth principal longitudinal vein of the wing, primitively with two branches, media anterior (MA) and media posterior (MP), only the latter occurring in Holometabola in which it is conventionally called media (M). In mosquitoes, M(i.e., MP) branches into media-one-plus-two ( $M_1+2$ ) and media-three-plus-four ( $M_3+4$ ), the former rebranching into media-one ( $M_1$ ) and media-two ( $M_2$ ). In mosquitoes, the basal part of  $M_{3+4}$  has often been called  $m-cu$  and the apical part,  $Cu_1$ . For alternate terminologies see table 1.

MEDIOCUBITAL CROSSVEIN (m-cu). - See CROSSVEIN. (Syn.: crossvein 4-5.) See Table 1.

MICROTRICHIMUM. - A minute, socketless, cuticular spicule. In mosquitoes, used for the minute hairs closely covering the wing membrane.

midhalter. - See HALTER.

outstanding scale. - See PLUME SCALE.

PEDICEL (Pc). - See HALTER.

petiole. - See HALTER.

plical scale. - See CUBITUS for plical vein. A term applied to scales occurring basoventrally on the cubitus posterior vein.

plical vein. - See CUBITUS.

PLUME SCALE (PlSc). - In mosquitoes, one of a set of erect and usually long narrow wing scales which together with the vein to which they attach somewhat resemble a plume feather. (Syn.: outstanding scale.)

POSTTARSUS (Pt). - The terminal segment of the arthropod leg, distal to the tarsus. (Syn.: pretarsus.)

pretarsus. - See POSTTARSUS.

PULVILLUS (Pv). - One of two padlike or divided lobes on the posttarsus of some insects, one arising below the base of each unguis.

RADIAL SECTION ( $R_S$ ). - See RADIUS.

RADIOMEDIAL CROSSVEIN (r-m). - See CROSSVEIN. (Syn.: crossvein 3-4.)

RADIUS (R). - The usual third principal longitudinal vein of the wing. In mosquitoes, four-branched: the stem of R branching into radius-one ( $R_1$ ; syn.: first longitudinal vein) and the radial sector ( $R_S$ ), the latter branching into radius-two-plus-three ( $R_{2+3}$ , syn.: second longitudinal vein) and radius-four-plus-five ( $R_{4+5}$ ; syn.: third longitudinal vein),  $R_{2+3}$  branching into radius-two ( $R_2$ ) and radius-three ( $R_3$ ).

remigial bristle. - See REMIGIAL SETA.

REMIGIAL SETA ( $ReS$ ). - 1. In Diptera, any seta on remigium (definition 2). In mosquitoes, the term is usually restricted to the setae inserted posterodorsally on the base of R, the ventral setae basally on Sc being termed SUBCOSTAL SETAE. 2. In Diptera, any seta on remigium (definition 3). (Syn.: remigial bristle.)

REMIGIUM ( $Re$ ). - 1. In winged insects, the part of the wing anterior to the vannal fold and distal to the basal fold (sense of Snodgrass 1935, 225). 2. In winged Diptera, the closely associated, though separate, bases of the subcosta and of the radius basad from the arculus (sense of Lowne 1890, 199, 201-202). 3. In winged Diptera, the part of the radius basad from the arculus (restricted sense of Belkin 1962, 552) (syn.: stem vein).

SCABELLUM ( $S1$ ). - See HALTER.

second longitudinal vein. - See RADIUS.

second marginal cell. - See CELL.

second posterior cell. - See CELL.

SECONDARY FRINGE SCALE (SFS). - In mosquitoes, a shorter fusiform scale attached in the intervals between the fringe scales of the wing fringe.

sixth longitudinal vein. - See ANAL VEIN.

squama. - See CALYPTER.

SQUAME SCALE (SS). - Any decumbent scale. In mosquitoes, usually applied only to the generally short, broad squame scales on the wing veins.

squamula. - See CALYPTER.

stalk. - See HALTER.

stem vein. - See REMIGIUM.

SUBCOSTA ( $Sc$ ). - The usual second principal longitudinal vein of the wing. (Syn. in Diptera: auxiliary vein.) In mosquitoes, two-branched: subcosta-one ( $Sc_1$ ) ending in the costa and subcosta-two ( $Sc_2$ ) (Syn.: subcostal crossvein) connected to R.

subcostal crossvein. - See CROSSVEIN.

SUBCOSTAL SETA (SuS). - See REMIGIAL SETA.

submarginal cell. - See CELL.

tarsal claw. - See UNGUIS.

TARSOMERE. - See TARSUS.

TARSUS (Ta-I, Ta-II, Ta-III). - In arthropods, the usual fifth leg segment located just distad to the tibia. It consists of one to many (five in mosquitoes) sub-segments called tarsomeres, referred to as tarsomere 1, 2, etc. (Ta-I<sub>1</sub>, Ta-II<sub>4</sub>, etc.)

tegula. - See CALYPTER.

TERTIARY FRINGE SCALE (TFS). - In mosquitoes, a small truncated scale of the female wing fringe only, set in two lines external to the line of fringe scales and of secondary fringe scales, one line dorsal and one ventral.

third longitudinal vein. - See RADIUS.

third posterior cell. - See CELL.

TIBIA (Ti-I, Ti-II, Ti-III). - In arthropods, the usual fourth segment of the leg, generally the long segment just distad to the femur (a patella intervenes in some arachnoids).

TROCHANTER (Tr-I, Tr-II, Tr-III). - A generally short segment (or either of two segments) between the coxa and femur of the arthropod leg; the usual second segment of the insect leg.

UNGUIS (U). - An anterior or posterior claw on the arthropod posttarsus. Either or both may be absent; usually both are present on the mosquito posttarsus. (Syn.: claw, tarsal claw.)

UNGUITRATOR (Un). - The ventral sclerite of the posttarsus on which the depressor of the posttarsus is inserted; sometimes (regularly in mosquitoes) produced apically as an empodium. (Syn.: unguitractor plate.)

unguitractor plate. - See UNGUITRATOR.

UPPER CALYPTER (US). - See CALYPTER.

VEIN. - One of the tubular thickenings of a wing; veins contain blood and often tracheae and nerves. See CROSSVEIN and the names of the principal longitudinal veins (COSTA, SUBCOSTA, RADIUS, MEDIA, CUBITUS, ANAL VEIN).

vein 6. - See ANAL VEIN.

WING FRINGE (WF). - In many winged insects, the row or rows of setae projecting beyond the membrane at the margin of the wing. In mosquitoes, most of the projecting setae are scales and the fringe is best developed from just beyond the alula around the posterior margin of the wing to near the wing apex.

WING SPOTS. - Both dark and pale scale spots occur on the wings of mosquitoes; for the most recent and suitable nomenclature for these spots see Belkin (1962, 551, fig. 235).

Table 1. Comparison of Terminology for Venation in the M-Cu-A Area of the Tipulid, Dixid, and Culicid Wings

Comstock 1918 fig. 365, p. 352 <u>Dixa</u>	Tillyard 1926 fig. W27, p. 349 <u>Dixa</u> <u>tasmaniensis</u>	Hennig 1954 fig. 47, p. 280 <u>Anopheles</u> <u>maculipennis</u>	Seguy 1959 fig. 97, p. 186 <u>Ptychoptera</u> <u>contaminata</u>	Christophers 1960 fig. 57.1 A. <u>aegypti</u>	Belkin 1962 p. 406 Generalized Culicid	Colless and McAlpine 1970*** fig. 34.17.D. <u>Anopheles</u> <u>annulipes</u>
M	(M)*	(m)	(MP)	Vein 4 [base]	M [base]	(M)
M	(M <sub>1</sub> +2)	(m <sub>1</sub> +2)	(MP)	Vein 4 [part past his m-cu]	M [part past his m-cu]	(M <sub>1</sub> +2)
M <sub>1</sub> +2	M <sub>1</sub>	m <sub>1</sub>	MP1	Vein 4.1	M <sub>1</sub> +2	(M <sub>1</sub> )
M <sub>3</sub>	M <sub>2</sub>	m <sub>2</sub>	MP2	Vein 4.2	M <sub>3</sub> +4	(M <sub>2</sub> )
m-cu	part of M <sub>3</sub> +4	part of m <sub>4</sub>	(mcu)	posterior cross vein	m-cu	part of M <sub>3</sub> +4
Cu	Cu <sub>1</sub>	(cu <sub>1</sub> )	(CuA1)	Vein 5	Cu [base]	(CuA)
Cu <sub>1</sub>	(m-cu)	[cu <sub>1a</sub> ]**	(CuA1)	Vein 5.1 [part before his m-cu]	Cu <sub>1</sub> [part be- fore his m-cu]	(m-cu)
Cu <sub>1</sub>	most of M <sub>3</sub> +4	m <sub>4</sub>	CuA1a	Vein 5.1 [part past his m-cu]	Cu <sub>1</sub> [part past his m-cu]	most of M <sub>3</sub> +4
Cu <sub>2</sub>	Cu <sub>1</sub>	cu <sub>1b</sub>	CuA1b	Vein 5.2	Cu <sub>2</sub>	CuA
1st A	Cu <sub>2</sub>	(cu <sub>2</sub> )	not clear: (CuA2 or CuP or both) cf. other fly figs.	cubital fold.	Plical	(CuP) cf. fig. 34.7B
2d A	1A	1a	1A	Vein 6	1A	1A

\*Parentheses around a symbol means figure not so labelled, but text or other figures make interpretation safe.

\*\* Compare his figure 5.

\*\*\* Terminology used in this paper.



## LITERATURE CITED

- Belkin, J. N. 1962. The mosquitoes of the South Pacific (Diptera, Culicidae) Vol. I Univ. Calif. Press. 608 p.
- Christophers, S. R. 1960. Aedes aegypti (L.) The yellow fever mosquito: Its life history, bionomics and structure. Cambridge, England. 738 p.
- Colless, D. H. and J. F. McAlpine. 1970. In: M. J. Mackerras (ed.), The Insects of Australia. Melbourne, Melbourne University Press, 1029 p.
- Comstock, J. H. 1918. The wings of insects; an exposition of the uniform terminology of the wing-veins of insects and a discussion of the more general characteristics of the wings of the several orders of insects. Ithaca, N. Y. The Comstock Publ. Co., 430 p.
- Hennig, Von W. 1954. Flugelgeader und System der Dipteren unter Berucksichtigung der aus dem Mesozoikum beschriebenen Fossilien. Beit. 3. Entomol. 4(3/4): 245-388.
- Knight, K. L. 1970. A mosquito taxonomic glossary. I. Adult head (external). Mosq. Syst. Newsletter 2(1): 23-33.
- Knight, K. L. and J. L. Laffoon. 1970a. A mosquito taxonomic glossary. II. Adult head (internal). Mosq. Syst. Newsletter 2(2):69-81.
- Knight, K. L. and J. L. Laffoon. 1970b. A mosquito taxonomic glossary. III. Adult thorax. Mosq. Syst. Newsletter 2(3):132-146.
- Lowne, B. T. 1890. The anatomy, physiology, morphology and development of the blow-fly (Calliphora erythrocephala). A study in the comparative anatomy and morphology of insects; with plates and illustrations executed directly from the drawings of the author. London, Pub. for the author by R. H. Porter.
- Seguy, E. 1959 Introduction a l'etude morphologique de l'aile des insectes. Mem. Mus. Hist. nat. (N.S.) (A) 21: 1-248.
- Snodgrass, R. E. 1935. Principles of Insect Morphology. McGraw-Hill, N. Y. 667 p.
- Tillyard, R. J. 1926. The insects of Australia and New Zealand. Sydney, Angus and Robertson, ltd., 560 p.

## ABBREVIATIONS

A	-anal vein and cell	PlSc	-plume scale
AI	-axillary incision	Pt	-posttarsus
Al	-alula	Pv	-pulvillus
Ar	-arculus	R	-radius (vein and cell)*
C	-costa (vein and cell)	Re	-remigium
C-I	-forecoxa	ReS	-remigial seta
C-II	-midcoxa	r-m	-radiomedial crossvein
C-III	-hindcoxa	R <sub>s</sub>	-radial sector
Ca	-capitellum	Sc	-subcosta (vein and cell)*
Cu	-cubitus	Sl	-scabellum
CuA	-cubitus anterior(vein and cell)	SS	-squame scale
CuP	-cubitus posterior (vein and cell)	SuS	-subcostal seta
Em	-empodium	Ta-I	-foretarsus
Fe-I	-forefemur	Ta-II	-midtarsus
Fe-II	-midfemur	Ta-III	-hindtarsus
Fe-III	-hindfemur	Ti-I	-foretibia
FS	-fringe scale	Ti-II	-midtibia
h	-humeral crossvein	Ti-III	-hindtibia
Hl	-halter	Tr-I	-foretrochanter
HP	-humeral plate	Tr-II	-midtrochanter
LC	-lower calypter	Tr-III	-hindtrochanter
M	-media (vein and cell)*	U	-unguis
m-cu	-mediocubital, crossvein	UC	-upper calypter
		Un	-unguitractor
		WF	-wing fringe

\*Subscript numerals are used to designate vein branches.

## EXPLANATION OF FIGURES

Fig. 25 Aedes (Ochlerotatus) grossbecki Dyar and Knab.

- a. Lateral aspect of fore leg.
- b. Lateral aspect of mid leg.
- c. Lateral aspect of hind leg.
- d. Lateral aspect of terminal portion of mid leg.
- e. Lateral aspect of terminal portion of fore leg.
- f. Mesal aspect of terminal portion of foretibia.
- g. Lateral aspect of terminal portion of hind leg.
- h. Ventral aspect of terminal portion of fore leg.

Fig. 26

- a. Wing of Aedes (Ochlerotatus) sticticus (Meigen).  
Ventral aspect.
- b. Wing of Uranotaenia lowii Theobald. Dorsal aspect.
- c. Enlarged view of wing margin of Fig. 26 a.
- d. Halter of A. (Ochl.) grossbecki.  
Lateral aspect.

Fig. 25

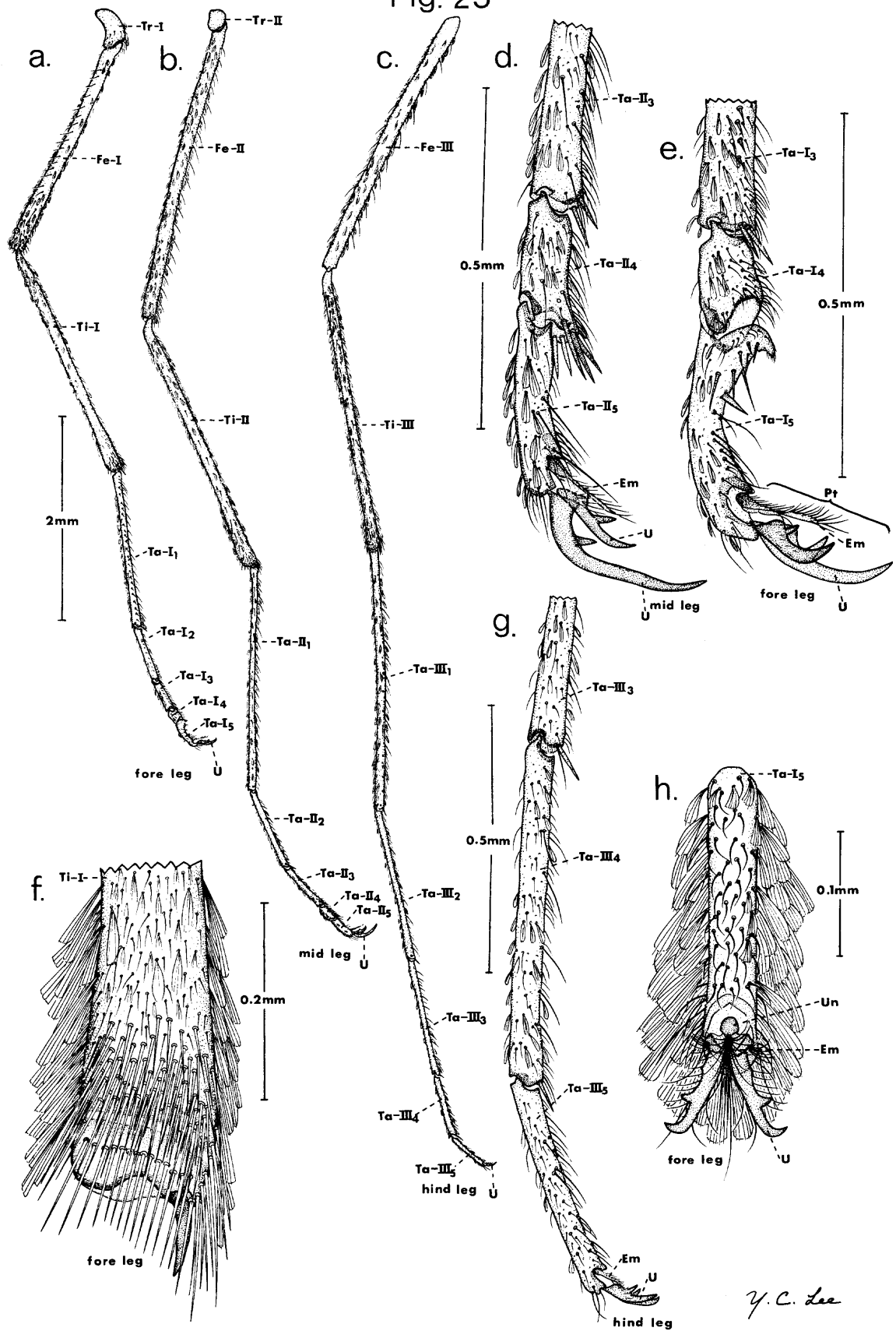
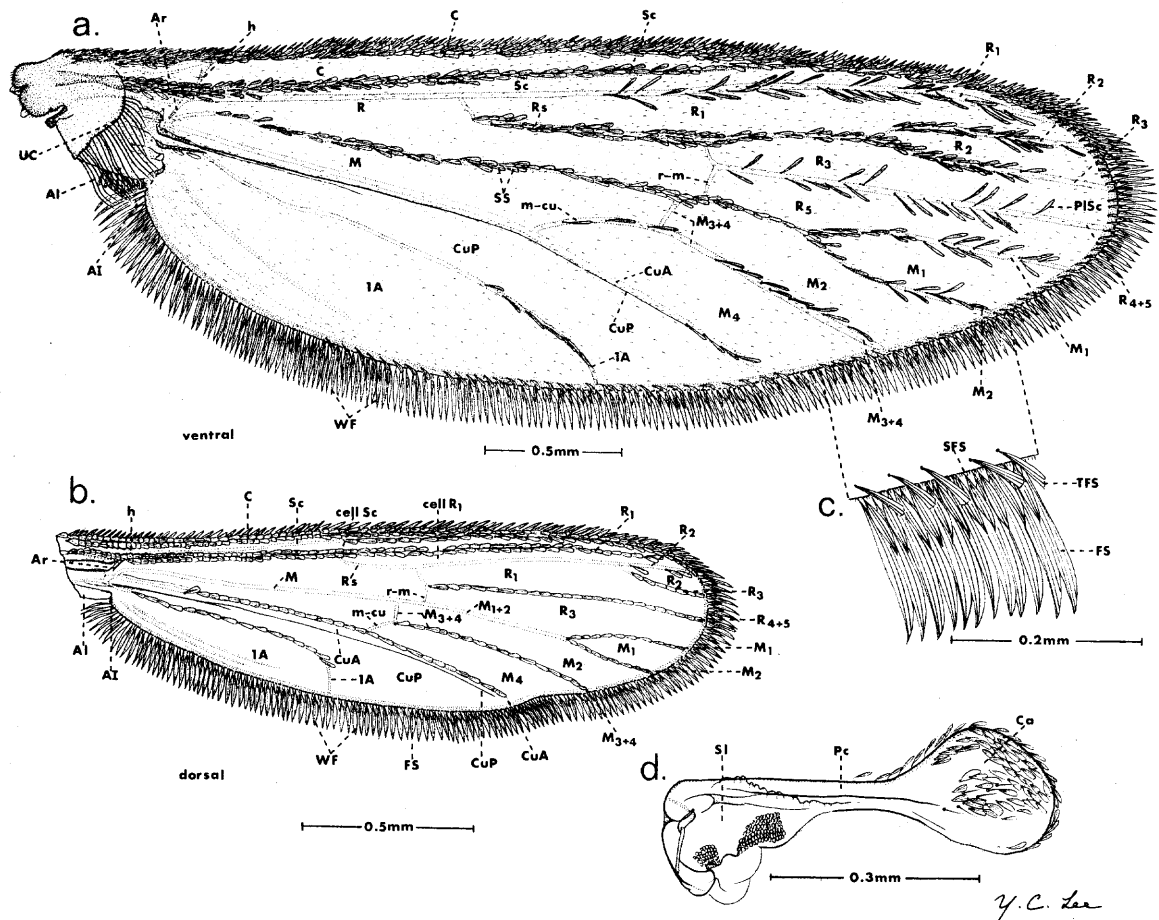


Fig. 26



## APPENDIX

As pointed out earlier this section is appended for the purpose of presenting reasons for the use of terms not presently in common acceptance.

CUBITUS. - The interpretation accepted here for the M-Cu-A area of the wing will be difficult for culicidologists to accept. However, the traditional interpretation applied to this area (Comstock 1918) and customarily used by culicidologists breaks down when an effort is made to apply it throughout the winged species of the class Insecta. Accordingly, Tillyard's (1926) modification, as newly designated by Colless and McAlpine (1970), has been accepted here.

HALTER. - This word is an application of the Latin and Greek word halter (pleural, halteres) for jumping-weight. Prior to about 1950, halter seems to have been the usual spelling used by entomologists, although haltere was also sometimes used. Since 1950 haltere has probably been used more than halter. We see no sound reason for adding an e to halter.

POSTTARSUS. - Widespread dissatisfaction with the inappropriate term pretarsus has led to several suggestions for substitutes (for a partial synonymy, see Dashman 1953, p. 60). We regard posttarsus as the best replacement name. It seems to have been coined independently at least three times (as posttarsus by MacGillivray 1923, p. 243 and 246; as posttarsus by Crampton 1942, p. 65; as French post-tarse by Millot 1949, p. 277). Some other workers, notably Fox and Fox 1964 (p. 62, as post-tarsus), have adopted it.

SUBCOSTA. - Although culicidologists have customarily treated the small portion of this vein connecting with radius as a subcostal crossvein, the traditional usage outside of mosquitoes since Comstock (1918) has been to consider this as subcosta two ( $Sc_2$ ). This has continued right up to the present (Colless and McAlpine 1970) and is accepted here.

References Newly Cited Here.

Dashman, T. 1953. Terminology of the pretarsus. *Ann. Entomol. Soc. Amer.* 46(1): 56-62.

Crampton, G. C. 1942. The external morphology of the Diptera. In, *Guide to the Insects of Connecticut. Part VI. Connecticut State Geo. and Nat. Hist. Survey Bull.* 64:10-165.

Fox, R. M. and J. W. Fox. 1964. *Introduction to comparative entomology.* Reinhold Publ. Corp., N. Y. 450 p

MacGillivray, A. 1923. *External insect anatomy; a guide to the study of insect anatomy and an introduction to systematic entomology.* Urbana, Ill.

Millot, J. 1949. Classe des Arachnides (Arachnida). I.-Morphologie generale et anatomie interne. p. 263-319. In: Pierre-P. Grasse (ed.), *Traite de Zoologie.* Vol. 6.